Radio-tracking Studies of Common Ringtail Possums, *Pseudocheirus peregrinus*, in Manly Dam Reserve, Sydney

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In radio-tracking studies in Manly Dam War Memorial Reserve, Common Ringtail Possums were found to survive an average of 319 days, with 80% of known deaths being due to predation by foxes and cats. The study area contained few large trees with hollows and 88% of the nest sites used were dreys. Any drey might be used by several possums, although rarely simultaneously. Ringtails were found to be sedentary, usually occupying dreys and foraging within a *Banksia ericifolia* thicket. Only 37% of the radio-tracked possums moved more than 50 m from their point of capture, and such movements often resulted in the establishment of a new foraging range. Males were more likely to make such shifts than females.

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INTRODUCTION

This paper reports a long-term study (1994-1999) of Common Ringtail Possums, *Pseudocheirus peregrinus*, in the Manly Dam War Memorial Reserve. It complements and extends an earlier study (Augee et al. 1996) carried out in Ku-ring-gai Chase National Park. The latter study was terminated by fires which burnt the study area in January 1994.

The Ku-ring-gai Chase study found mean survival of Common Ringtail Possums to be 101 days after the commencement of radio-tracking. It provided the first quantitative evidence of high levels of predation on possums by foxes and cats (Rose et al. 1994, Augee et al. 1996), perhaps related to the unexpected finding that up to 10% of the nest sites were on the ground (Augee et al. 1996). Unlike other possums, ringtails are not dependent on tree hollows for nesting sites. They use tree hollows but also construct free-standing nests, known as "dreys", that are often mistaken for birds' nests. Ringtail dreys are larger and more spherical than those of birds except for some babblers, none of which occurred in either study area. Nests on the ground were usually constructed in grass clumps and varied in structure from simple depressions to fully lined shelters similar to arboreal dreys.

Most of the possums radio-tracked in the Ku-ring-gai study were introduced into the area and it is possible that their behaviour was atypical compared to lifetime residents. The Manly Dam Reserve study was based on resident, "wild" ringtails and was designed to determine if the high levels of predation and patterns of nest usage reported by Augee et al. (1996) are a widespread occurrence or simply the result of unusual conditions prevailing in the Ku-ring-gai Chase study.

The Manly Dam Reserve study site was selected because it seemed likely to be less susceptible to bushfire than Ku-ring-gai Chase. That assumption turned out to be incorrect as part of Many Dam Reserve did burn, but only after this study was completed. Both studies areas are Sydney sandstone woodland, although Manly Dam Reserve contains relatively few large trees with hollows compared to Ku-ring-gai Chase.

The Manly Dam Reserve study was designed not only to provide data on survival and nest usage of wild Common Ringtail Possums, but also to run long enough to gather data on long term movements and dispersal of individuals and intraspecific relationships.

In the course of radio-tracking incidental data were obtained, particularly in regard to reproduction.

MATERIALS AND METHODS

The study area

The study area comprised 8 ha in the north-west corner of the Manly Dam War Memorial Reserve as shown in Fig. 1. Its topography was undulating and consisted of moderately sloping hillsides around the headwaters of Curl Curl Creek and tributaries. The vegetation was predominantly dry sclerophyll shrubland and heathland on Hawkesbury Sandstone. Five vegetation communities were identified within the Manly Dam Reserve study area:

Banksia ericifolia Thicket: Scrub to 4 metres height and 60-70% cover. Predominantly *Banksia ericifolia*, with *Kunzea ambigua* and *Hakea teretifolia.*

Low Open Woodland: Low eucalypts to 8 metres at 3 - 4 metre intervals. Dominated by Red Bloodwood *Corymbia gummifera* and stringybarks. Sparse shrub layer and dense sclerophyllous ground layer.

Heathland/Low Open Woodland: Dense low shrubs and grassland to 2 metres, with areas of low, scat-

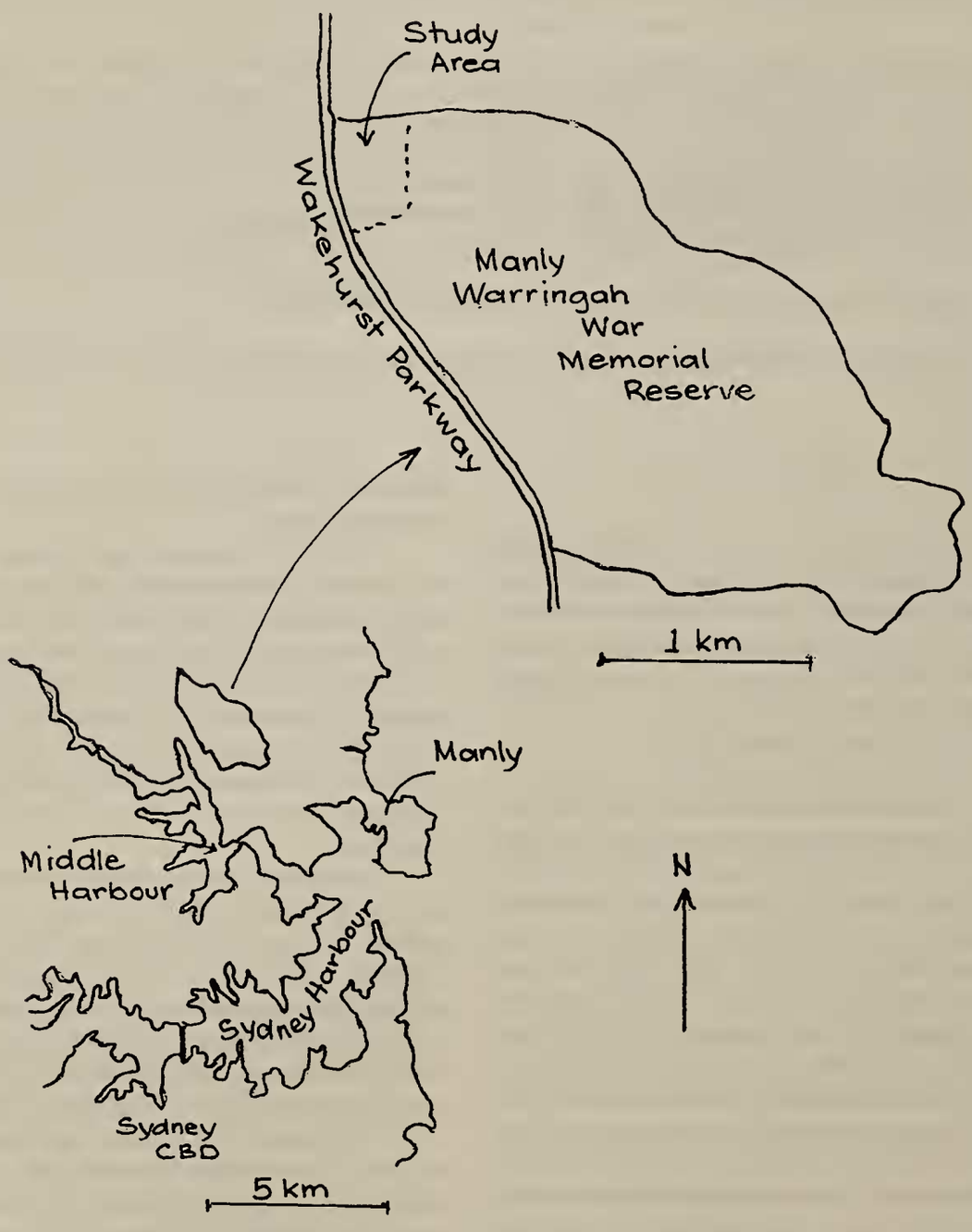

Figure 1. The study area in Manly Dam War Memorial Reserve.

tered eucalypts to 8 metres.

Open Forest: Trees to 20 metres and 30 - 40% cover. Dominant species include Sydney Peppermint *Eucalyptus piperita*, Smooth-barked Apple *Angophora costata*, Red Bloodwood *Corymbia gummifera*, Silver-top Ash *E. sieberi* and stringybarks.

Riparian Open Forest: Trees to 20 metres height along the bank and floodplain of the creekline. Dominated by Black Wattle *Callicoma serratifolia* and eucalypts with a shrub layer of *Banksia ericifolia* and a ground layer with sedges such as *Gahnia* spp. and Coral Fern *Gleichenia* spp.

Animals

Seventy-nine ringtails were caught in the study area and fitted with radio-collars. They were designated with numbers 242-320. Sex is indicated by the prefix F for females and M for males. Individual details are given in Appendix I. Individuals weighing less than 600 g were classified as juveniles.

For ringtails that had been followed since they were pouch young, their mother was of course known. We were able to identify probable fathers in cases where nest sharing with the mother had been observed at about the right time for conception and where nest sharing between an adult male and the juvenile was observed.

Radio-tracking system

Ringtails were caught by shaking them from low lying trees or bushes, fitted with radio-transmitters built into collars and subsequently located by tracking the radio signal as described in Augee et al. (1996).

The process of capture and collaring usually resulted in the animal moving to a nest other than the one in which it had been captured, but on only one occasion was that nest site out of the foraging range. One individual (F245), after it took several attempts to recapture her and replace a faulty transmitter, dispersed immediately by 110 m to a new foraging range in which she remained for more than two years.

Data collection

The position of each Ringtail was usually determined weekly, although more frequent determinations were often made in the first few weeks after a collar was fitted. The nest site (drey, tree hollow, ground nest or other) was recorded.

When radio collars were replaced in order to change batteries, pouches of females were examined. The presence and estimated weight of any joeys was noted. Approximate date of birth was extrapolated from the growth curve published by Smith (1995, p. 37).

Probable cause of death was determined from corpses using the criteria set out in Augee et al. (1996). Briefly, intact transmitter collars with little distortion found in association with scattered fur but no body parts were scored as fox kills. Cached collars and collars located a considerable distance from the last recorded nest site were also scored as fox kills. However mangled corpses or collars found with body parts (usually heads, paws, intestines and often the caecum) were scored as cat kills.

Foraging and home ranges

In a separate study of ringtails carried out by Newton (1997) at Manly Dam, the areas used by individual ringtails foraging around their nesting sites were found to average 0.020 ha for females and 0.034 ha for males. These foraging ranges had a maximum diameter of about 50 m. In the present, long-term study therefore we considered movements less than 50 m as foraging movements and movements over 50 m as exploratory. These longer movements may or may not have resulted in a shift of foraging range. When ringtails were found to establish a new foraging range, new nest sites more than 50 m from their previous site were considered to be dispersal. We use the term "home range" to refer to the sum of all foraging areas used by an individual throughout the course of the study. Home ranges are illustrated in figures by the smallest convex polygon that can be drawn to connect the outermost recorded nest sites. Only data for those animals (62 out of 79) that were tracked for more than a month were used in determination of home ranges.

Survival statistics

Where mean survival is given it has been calculated only for individuals whose date of death could be determined.

Survival functions for various data subsets were estimated using software provided by K.H. Pollock based on his (Pollock et al. 1989) modification for staggered entry of animals of the Kaplan-Meier product limit estimator (Kaplan and Meier 1958) as detailed in Augee et al. (1996). The survival functions in this study and the previous Ku-ring-gai Chase study (Augee et al. 1996) were based on weekly observations.

RESULTS

Survival

The mean survival of all ringtails was 319 days after commencement of radio-tracking (n = 60, SD = 336, median = 172 days). Mean survival of adults was 465 days (n = 33, SD = 374, median = 371 days). Mean survival of juveniles was 140 days (n = 27, SD = 156, median = 90 days).

The mean survival of all resident ringtails was

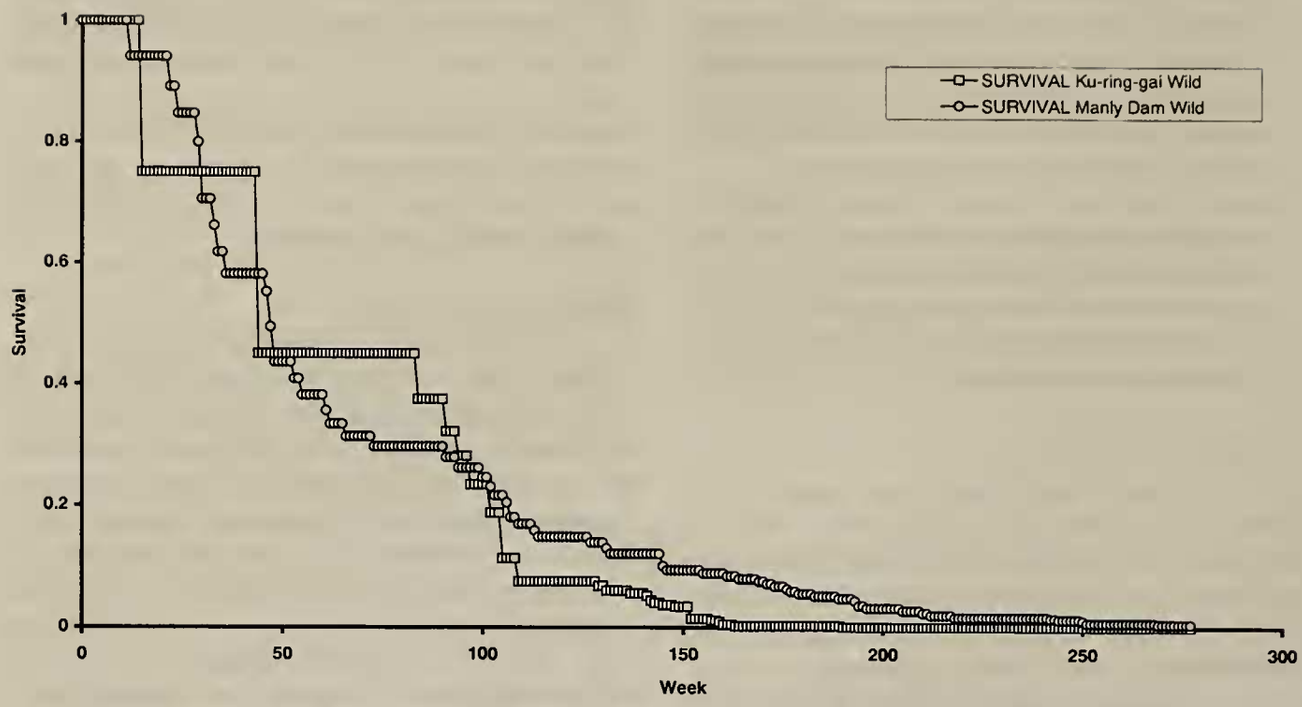

Figure 2. Comparison of Kaplan-Meier survival functions (modified for staggered entry) for all wild ringtails radio-tracked at Manly Dam Reserve (n=78) and Ku-ring-gai Chase (n=41). Chi-squared = 10.227; P<0.01.

much greater at Manly Dam Reserve (319 days) than at Ku-ring-gai Chase (182 days). The Kaplan-Meier survival functions, modified for staggered entry of animals, for all wild possums tracked at Manly Dam Reserve and at Ku-ring-gai Chase are shown in Fig. 2. The survival function for the Manly Dam Reserve population is significantly lower (Chi-squared = 10.227, P<0.01).

Figure 3 compares the survival functions for juvenile and wild ringtails at Many Dam Reserve. The relatively low survival function for juveniles is highly significant (Chi-squared = 13.069, P<0.001).

Predation

The fates of all 79 resident ringtails radio-tracked are shown in Table 1. Predation by introduced

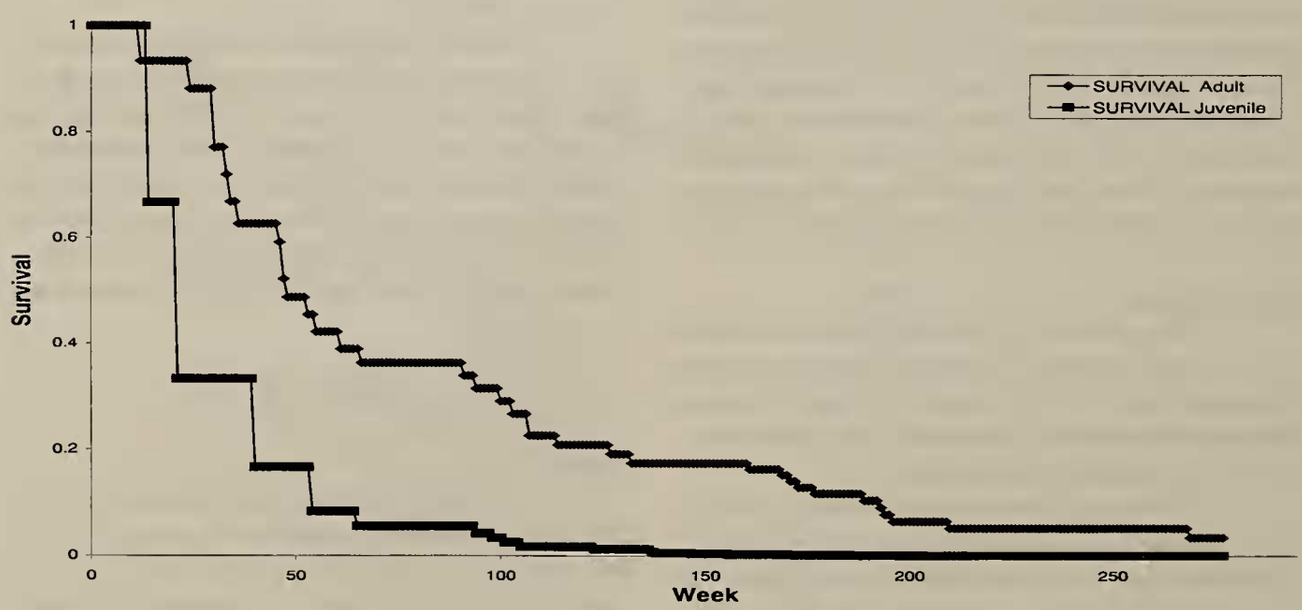

Figure 3. Comparison of Kaplan-Meier survival functions (modified for staggered entry) for adult ringtails (top curve, n=44) and juveniles (n=34) at Manly Dam Reserve. Chi-squared = 13.069, P<0.001.

Table 1. Fate of Common Ringtail Possums tracked in Manly Dam Reserve 1994-1999 and Ku-ring-gai Chase National Park 1990-1994

FATE	Manly Dam	Ku-ring-gai Wild	Ku-ring-gai Introduced
Killed by fox	28	18	39
Killed by cat	20	4	28
Radio-signal lost, reason undetermined	12	8	27
Killed on road	9		1
Still alive at end of study (collar removed)	4		
Transmitter failed, seen but not recaught	3		
Killed by python	1	3	5
Killed by goanna	1		6
Killed by raptor	1		2
Killed by unknown predator		1	4
Killed in bush fire		4	1
Total	79	38	113

carnivores (foxes and cats) was heavy; 80% of known causes of death (Table 1).

Nest sites

During this study a total of 2,907 daytime positions was determined by radio tracking. Of these, 88% were in dreys, 6.1% were on the ground and 3.6% were in tree hollows.

Dreys were constructed in tree/shrub species listed in Table 2 with the majority in *Banksia ericifolia*. On average, individual ringtails at Manly Dam Reserve used seven different dreys during the period they were radio-tracked. The actual number ranged from one to 21 depending mainly on the length of time any one possum was tracked.

The figure for usage of ground positions (6.1%) is skewed by one individual (M275) that was located 70 times on the ground after having dispersed to an area of heathland where there were no shrubs, bushes or small trees sturdy enough to support a drey. If this animal is excluded, only 4% of the locations were on the ground.

Sharing of nest sites

Dreys were used and kept in repair by more than one individual ringtail. Table 3 lists single and multiple occupancies for all known nesting sites in one thicket. The thicket illustrated had the greatest use of any in the study area. Table 3 contains an example of nest sharing within a family, with each parent (F266 and M295) sharing with each other and on separate occasions with offspring (M307 and M308). F266 also shared with her daughter F292, the father of which is unknown.

Competition

There is some evidence for exclusion as a result of competition. In two cases ringtails moved into an area immediately after an occupying ringtail died (M261 replaced M244, and F242 replaced F243). In

Table 2. Characteristics of four thickets in the Many Dam study area. Common Ringtail Possums listed as occupants did not necessarily overlap in time. Area and floristic data from Newton (1997).

OCCUPANTS	THICKET AREA (ha)	SPECIES IN WHICH NESTS OCCURRED
M263, F266, M295, M307, M308	0.165	*Banksia ericifolia, Kunzea ambigua* and *Corymbia gummifera*
F242, M254, M279, M300	0.12	*B. ericifolia, K. ambigua, Hakea teretifolia,* and *E. punctata*
M290, M297, F298, F311	0.18	*B. ericifolia, K. ambigua, H. teretifolia,* and *E. haemastoma*
F136, M246, F248, F249, M282	0.275	*B. ericifolia, K. ambigua, B. serrata, H. teretifolia,* and *E. haemastoma*
F253, M264, M284, F287, M310	0.16	*B. ericifolia, K. ambigua, Callicoma serratifolia, E. punctata* and *Leptospermum trinervium*

Table 3. Occupancy of dreys in a single thicket by Radio-collared ringtails during the period 1994-1999. Cases where occupancy was simultaneous are indicated by / and bold. *M307 and M308 are siblings; M295 is their father; F266 is their mother, ** F266 is the mother of F292

Drey designation	Occupiers
C1a	**M259/F132**
C1	F242, M263, M261, M289
C2	**M259/F266**, M263, F285
C3	**F266/M259**
C4	**M295/F266**, M308, M307
C5	M259, M263
C6	F285, M259, M263
C7	M259
C8	M263, M259
C9	M259, **F266/M295**, M263, M244, M261, F249, **M279/F292**, **M295/M307/M308***
C10	F266, M259, M263, M244
C11	M295
C11a	**F266/M307***
C12	M263
C13	F289, M263, M279
C14	M263
C15	**M263/F277**
C16	F277
C17	F266, M295, M263, **M307/M308***
C18	F289
C19	M259, **F266/F292****, F289
C20	F266, M295
C21	M295
C22	**M295/F266**, M307
C23	F266, **M307/M308***
C24	M295
C25	**F266/M307**, M295
C26	M295

Table 5 shows that some ringtails remain for extended periods, in some cases their entire life, in the same foraging area (thicket) in which they were born.

Distribution of nesting sites and home ranges

Fig. 4 is a plot of all nesting sites on a map of the study area. All nesting sites for any given individual are enclosed in the smallest polygon that can be formed by joining outer sites for that animal to form an estimate of home range. The distribution is patchy across the study area and the overlapping concentrations of home ranges correspond to the distribution of thickets (Fig. 4). The thickets were composed primarily of *Banksia ericifolia* and *Kunzea ambigua*. Details of the floristics (from Newton 1997) of four thickets in the study area are given in Table 2. Nest sites rarely occurred in large trees. Over the entire period of this study only five dreys were found in *Eucalyptus* or *Angophora* spp.

another case, M275 dispersed from the foraging area he had occupied for four months after another male, M264, incorporated that area into his own. M275 thereafter remained in his new foraging range.

Movements

Table 4 sets out all instances for ten individuals in which exploratory movements from one nest site resulted in the occupation of a new nest site more than 50 m away. The number of these movements for an individual varied from one (F245) to 13 (F296) (Table 4). It is important to note that 39 of the 62 animals tracked for more than one month did not make any exploratory movements and remained within 50 m of the point at which they were initially captured and collared.

Forty-four percent of males tracked made exploratory movements while only 28% of the females did so.

Reproduction

When the pouches of females at the time of radio-collar replacement were examined, almost all were found to contain joeys. Although Pahl (1987) found numerous single births in southern Victoria, in this study all mothers with pouch young were found to be carrying twins; not one instance of single birth was found. Pouch young were attached to the posterior pair of nipples (ringtails have two pairs of nipples in the pouch). The annual distribution is shown in Fig. 5, from which it appears that breeding occurs throughout the year, with a peak of births in May and November, and a trough in January-March.

DISCUSSION

Mean survival of wild possums at Manly Dam Reserve (319 days) was greater than determined for

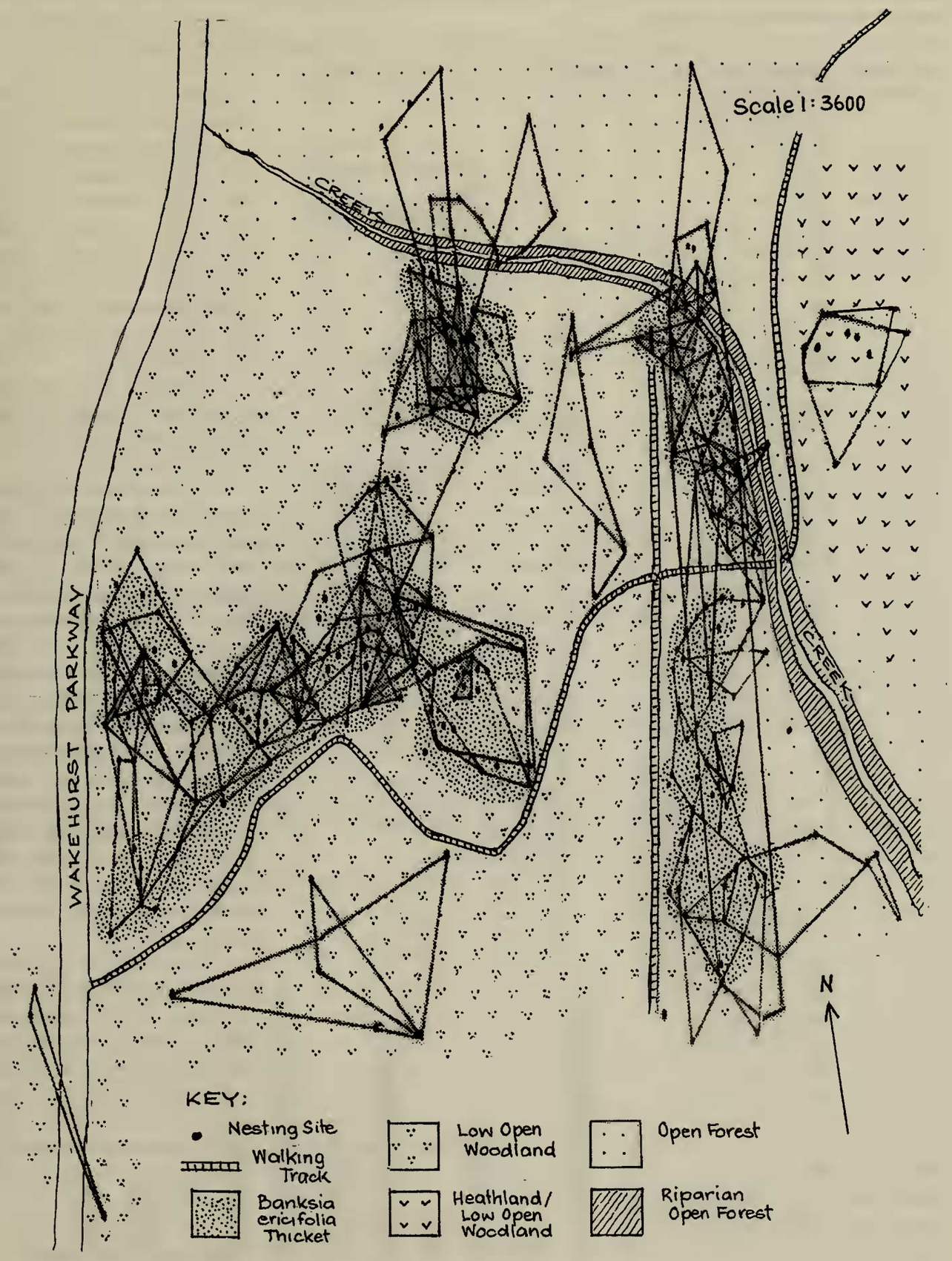

Figure 4. Home ranges (as defined in the text) of all ringtails radio-tracked at Manly Dam Reserve 1994-1999 superimposed on a vegetation map of the study area. Dots = nest sites. Vegetation communities are defined in "Methods" above.

Table 4. Examples of long distance movements by Common Ringtail Possums in Manly Dam Reserve. For each ringtail listed all known movements over 50 m are given.

Animal	Distance (m)	Duration (days)	Terminal event
F242	55 (from a to b)	18	
	55 (return to a)	14	
	55 (return to b)	1140	killed by fox
F245	110	741	killed by goanna
M254	122	7	
	105	14	road kill
M261	50	36	
	68	21	
	53	14	
	65	21	
	64	539	
	56	21	killed by fox
M264	75	28	
	110	764	killed by cat
M275	122	370	
	88	7	
	65	78	transmitter failed
M279	65 (a to b)	7	
	63 (return to a)	7	
	63 (return to b)	266	
	94	21	
	104	14	
	89	1	roadkill
F289	86	14	
	61	7	
	61	27	
	74	39	
	51	17	
	61	42	
	121	43	
	83	293	killed by fox
F296	110	14	
	121	28	
	135 (a to b)	7	
	135(return to a)	34	
	131	7	
	131	21	
	145	7	
	136	28	
	159	21	
	232	14	
	293	7	
	94	30	
	373	1	killed by cat
M317	88	28	
	84 (a to b)	10	
	84 (return to a)	4	killed by fox

wild possums in the previous study at Ku-ring-gai Chase (182 days; Augee et al. 1996). Likewise the survival functions for these two data sets (compared in Fig. 2) indicate a significantly ($p<0.01$, Chi-squared = 10.227) lower survival function for wild possums in the Ku-ring-gai study. The major cause of death is predation by foxes and cats; 80% at Manly Dam Reserve and 76% at Ku-ring-gai Chase. Usage of ground nest sites is also similar in both studies; 6% at Manly Dam Reserve and 7% at Ku-ring-gai Chase. The most likely explanation for the apparently greater life expectancy at manly Dam Reserve is lower numbers of introduced predators, but there is no way to test this hypothesis with available data.

Juveniles are clearly at greater risk than adults, having a significantly lower survival function (Fig. 3).

The vegetation within the Manly Dam Reserve study area consisted mostly of low heath, with taller mature eucalypts and riparian vegetation along a creek line and *Banksia/Kunzea* thickets separated by low scrubby heath. Ringtails preferred the thickets, constructing dreys primarily in *Banksia ericifolia* and to a lesser extent in the low trees and sturdy bushes listed in Table 2. Some ringtails utilized hollows in the trees near the creek line and one individual utilized the heath, making several nests on the ground.

In Ku-ring-gai Chase the figure for usage of tree hollows was about 33% (Augee et al. 1996). In Manly Dam Reserve there are few large, mature trees and only 3.6% of daytime positions were in hollows. One animal also nested briefly in an arboreal termite mound about 5 m up a eucalypt tree.

At any given time, a ringtail would use several nest sites, most often within a single thicket. Around these sites the animal would forage over an area usually less than 0.2 ha with a maximum diameter of 50 m. This foraging range was consistent regardless of the habitat,

Table 5. Residency time of progeny that never left their natal sites. All were juveniles (<600 g) at time of collaring. Days are measured from time of collaring.

Subject	Female Parent	Probable Male Parent	Natal Area Days	Killed in natal area or moved
M259	F249	M244	638	K
F274	F248	M246	35	K
F278*	F242	M254	27	M
M279*	F242	M254	519	K
M282	F248	M246	967	K
M284	F245	M280	232	M
F291	F245	M280	37	K
F296	F287	M264	158	M
M297	F298	M290	253	M
M307*	F266	M295	293	K
M308*	F266	M295	166	M
F311	F298	M290	89	M
M318*	Uncollared	Uncollared	211	M
F319*	Uncollared	Uncollared	83	K

being observed for animals living along the creekline amongst large trees as well as in thickets.

Like many arboreal mammals (e.g. squirrels, McDonald 1984), ringtails are sedentary. At Manly Dam Reserve 39 of the 62 animals tracked remained within the foraging range where they were first caught. One female (F273) remained in the same foraging range for 582 days until being killed by a fox.

The sedentary nature of the species is further evidenced by data obtained from 14 individuals for whom their female parent and place of birth were known (Table 5). Of the seven ringtails that were killed within the natal area (i.e. within 50 m of the site of their birth), four had lived there for extended periods from the time of being collared (293, 519, 638 and 967 days).

Some ringtails did move out of their foraging range, occasionally establishing a new nest site more than 50 m from the previous nest site. In a few instances the animal quickly returned (F242, M279, F296 and M317 in Table 4), however most such movements resulted in the establishment of a new foraging range. For example F312 remained in the foraging area where she was first caught for 90 days, then moved about 800 m to a new foraging range, remaining there 174 days. At that time her collar was removed since this unusually large dispersal movement had taken her out of the study area.

Dispersal movements, resulting in the establishment of a new foraging range, were made by both sexes, although more males (15) did so than females (8). However, the animal making the greatest number and longest dispersal moves was a female (F296, Table 4). The animal making the second greatest number of moves was also a female (F289, Table 4). The reasons for such shifts in foraging range are unclear.

In many mammalian species there is a pattern of dispersal by juveniles (McDonald 1984). Some of the ringtail dispersals observed in this study were by juveniles (e.g. M264, M279, F296 and M317 in Table 4). However dispersal of juveniles was not a consistent pattern as only 10 out of 26 (38%) of juveniles tracked for more than a month made dispersal movements. Of the juveniles with known parents (Table 5), three (M282, M279 and M259) remained within the parental foraging range after the death of the parents. As can be seen from Table 3, M307 and M308 remained in association with both parents. One female of known parents (F296) made frequent moves greater than 50 m from the parental foraging area, usually returning, until killed by a cat 280 m from the parental foraging area (at which time

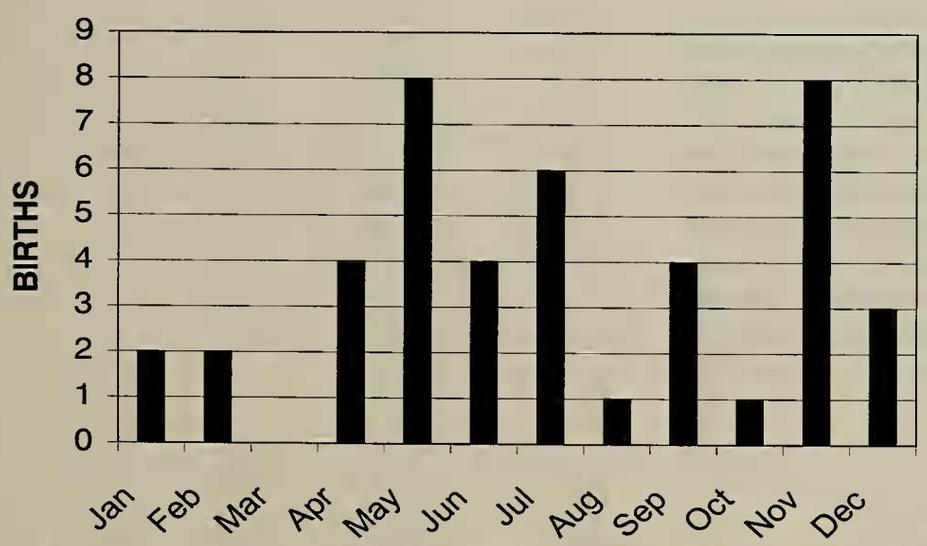

Figure 5. Annual distribution of births of Common Ringtail Possums at Manly Dam Reserve.

both parents were still alive).

On the other hand, most ringtails in this study were mutually tolerant with considerable overlap in home range (Fig. 4) and foraging range (Table 2). Individual dreys were used by as many as 11 different individuals (Table 3). Simultaneous occupancy occurred (Table 3), usually by adult males with adult females and rarely two males. We did not observe simultaneous occupation of a drey by two adult females, although on one occasion the same drey was used by two adult females (F242 and F243) on different nights over a period of 3 weeks . We observed many instances of females sharing with joeys that were too small to radio-collar. In the only instance where we were able to track parents and their offspring simultaneously (F266 and M295, parents of M307 and M308), they were found to frequently share nest sites (see Table 3). The degree to which this familial tolerance continues as the juveniles reach maturity is unknown.

Although there was no evidence that any movements made by the ringtails were related to predation, the majority of ringtails in this study, as in the study carried out earlier in Ku-ring-gai Chase (Augee at al. 1996), were killed by predators, usually foxes or cats (Table 1). While it is possible that deaths due to "unknown predators" in the Ku-ring-gai Chase study might have been due to dogs, we feel it unlikely that any deaths were due to dogs but misidentified at Manly Dam Reserve. Dogs are not allowed in the reserve unless on a lead and this rule is actively policed and well respected by local residents. During the entire course of the study we saw only one dog off the leash.

CONCLUSION

Ringtail possums are usually sedentary, remaining within a foraging range of approximately 50 m diameter in the Manly Dam Reserve study area. They may on occasion move beyond this range, although the reasons for such long distance movements are unknown. They are probably all exploratory, but most result in the establishment of a new foraging range and can be considered dispersal movements. Presumably the new foraging range provides improved feeding or reproductive resources or less competition with conspecifics. Predation by foxes and cats was severe throughout the study area.

REFERENCES

Augee, M.L., Smith, B. and Rose, S. (1996). Survival of wild and hand-reared ringtail possums (*Pseudocheirus peregrinus*) in bushland near Sydney. *Wildlife Research* **23**, 99-108.

Kaplan, E.L. and Meier, P. (1958). Nonparametric estimation from incomplete observations. *Journal of the American Statistical Association* **53**, 457-481.

McDonald, D. (ed.). (1984). The encyclopedia of mammals. Unwin Hyman, London

Newton, T. (1997). Foraging range in the common Ringtail Possum (*Pseudocheirus peregrinus*). Honours Thesis, University of NSW (held by the School of Biological, Earth and Environmental Sciences, UNSW, Sydney 2052).

Pahl, L.I. (1987). Survival, age determination and population age structure of the Common Ringtail Possum, *Pseudocheirus peregrinus*, in a *Eucalyptus* woodland and a *Leptospermum* thicket in southern Victoria. *Australian Journal of Zoology* **35**, 625-639.

Pollock, K.H., Winterstein, S.R., Bunck, C.M. and Curtis, P.D. (1989). Survival analysis in telemetry studies: the staggered entry design. *Journal of Wildlife Management* **53**, 7-15.

Rose, S., Augee, M.L. and Smith, B. (1994). Predation by introduced foxes on native mammals: a study of fox scats from Ku-ring-gai Chase National Park, Sydney. In "Proceedings of the 1994 Conference of the Australian Association of Veterinary Conservation Biologists" (Eds A.W. English and G.R. Phelps). pp. 111-116. Australian Association of Veterinary Conservation Biologists: Sydney.

Smith, B. (1994). Caring for possums. Kangaroo Press, Sydney.

APPENDIX I
Details for all ringtails in the Manly Dam Reserve study

No.	Sex	Weight	Collar attached	Collar retrieved	Survival (days)	Fate
242	F	770g	7/9/94	3/12/97	1181	FOX
243	F	995g	7/9/94	4/5/95	238	CAT
244	M	785g	7/9/94	27/4/95	231	CAT
245	F	800g	7/9/94	17/12/97	1196	GOANNA
246	M	900g	14/9/94	26/9/96	742	FOX
247	F	940g	14/9/94	26/7/95	314	FOX
248	F	750g	21/9/94	29/8/96	708	CAT
249	F	880g	21/9/94	8/8/96	687	FOX
250	F	920g	21/9/94	13/9/95	356	CAT
251	F	950g	21/9/94	27/9/95	370	CAT
252	M	770g	12/10/94	6/4/95	175	CAT
253	F	780g	12/10/94	6/4/95	175	FOX
254	M	810g	7/11/94	10/8/95	275	ROADKILL
255	M	870g	7/11/94	23/3/95	135	TX.Failure
256	F	400g	7/11/94	30/3/95	142	ROADKILL
257	F	930g	7/11/94	30/11/94	22	CAT
258	M	420g	16/11/94	8/2/95	83	CAT
259	M	550g	11/1/95	10/10/96	638	CAT
260	M	800g	11/1/95	22/2/95	41	ROADKILL
261	M	700g	11/1/95	13/11/96	672	FOX
262	M	700g	15/2/95	20/5/95	93	ROADKILL
263	M	675g	15/2/95	26/9/96	588	CAT
264	M	620g	13/4/95	23/4/98	11O6	CAT
265	M	940g	4/5/95	29/6/95	55	SIGNAL LOST
266	F	700g	11/5/95	27/5/98	1112	CAT
267	M	890g	11/5/95	5/6/96	389	CAT
268	M	720g	12/7/95	2/8/95	20	RAPTOR
269	F	940g	12/7/95	2/8/95	20	FOX
270	M	930g	12/7/95	21/5/98	1005	FOX
271	M	995g	19/7/95	11/10/95	83	FOX
272	F	550g	19/7/95	9/8/95	20	CAT
273	F	760g	9/8/95	20/3/97	588	FOX
274	F	595g	11/10/95	15/11/95	35	FOX
275	M	830g	8/11/95	8/10/97	700	TxEXPIRE
276	F	675g	8/11/95	15/5/96	199	SIGNAL LOST
277	F	675g	15/11/95	13/12/95	28	FOX
278	F	550g	3/1/96	31/1/96	28	ROADKILL
279	M	580g	17/1/96	19/6/97	519	R0ADKILL
280	M	970g	17/1/96	26/6/96	159	FOX
281	M	920g	17/1/96	28/2/96	42	SIGNAL LOST
282	M	625g	13/3/96	6/11/98	967	CAT
283	M	460g	26/6/96	22/8/96	57	FOX
284	M	510g	26/6/96	10/3/97	258	FOX
285	F	570g	22/8/96	21/9/96	30	FOX
286	F	860g*	29/8/96	13/2/97	168	PYTHON
287	F	720g	5/9/96	19/2/98	532	SIGNAL LOST

No.	Sex	Weight	Collar attached	Collar retrieved	Survival (days)	Fate
continued						
288	M	560g	12/9/96	7/11/96	56	FOX
289	F	850g	26/9/96	28/1/98	489	FOX
290	M	900g	17/10/96	14/10/98	726	SIGNAL LOST
291	F	455g	29/12/96	5/2/97	37	SIGNAL LOST
292	F	460g	8/1/97	13/2/97	35	SIGNAL LOST
293	M	440g	15/1/97	19/6/97	155	FOX
294	F	490g	26/2/97	26/6/97	120	CAT
295	M	580g	20/3/97	8/12/98	509	SIGNAL LOST
296	F	420g	27/3/97	22/1/98	300	CAT
297	M	300g	24/4/97	12/3/98	352	FOX
298	F	890g	1/5/97	29/12/99	971	RELEASED
299	M	520g	29/5/97	19/6/97	20	FOX
300	F	375g	13/8/97	27/8/97	13	ROADKILL
301	F	725g	20/8/97	3/11/99	804	FOX
302	F	700g	20/8/97	16/9/98	385	CAT
303	F	625g	20/8/97	29/12/99	860	RELEASED
304	M	650g	20/8/97	1/1/98	133	Tx.FAILURE
305	M	850g	27/8/97	10/12/97	118	SIGNAL LOST
306	F	355g	15/10/97	26/10/97	10	FOX
307	M	265g	10/12/97	30/9/98	293	CAT
308	M	255g	10/12/97	27/5/98	167	ROADKILL
309	M	450g	21/1/98	18/11/98	300	SIGNAL LOST
310	M	475g	11/2/98	6/11/98	119	SIGNAL LOST
311	F	340g	30/9/98	30/9/98	90	ROADKILL
312	F	320g	6/11/98	12/2/98	173	RELEASED
313	F	450g	9/2/98	30/9/98	27	SIGNAL LOST
314	F	350g	14/10/98	11/11/98	27	FOX
315	F	245g	13/1/99	28/4/99	1O4	FOX
316	M	300g	27/1/99	5/12/99	104	FOX
317	M	400g	24/3/99	30/6/99	97	FOX
318	M	310g	4/7/99	29/12/99	265	RELEASED
319	F	300g	4/7/99	30/6/99	83	FOX
320	M	250g	6/2/99	23/6/99	20	CAT